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Using Field Data to Improve Authorized Stockage List Push Packages

Marygail K. Brauner, Arthur Lackey, John Halliday

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Preface

When the Army fields new equipment, the program manager works with the vendor to develop initial lists of repair parts for sustainment. Although new equipment fieldings typically occur in phases over time, empirical demand data from the earliest fieldings are not systemically used to update the sustainment parts list. As a result, even for systems that have been in service for years, the initial parts provisioning packages, referred to as "push" packages, may still be based on the original engineering estimates of failure rates, with little or no empirical demand data from field experience incorporated. If push packages for a system provide low fill rates for parts that are drivers of low equipment readiness, which has frequently been the case, readiness problems can occur.

This documented briefing, developed as part of the project "Using Field Data to Improve Initial Parts Support for New Equipment," demonstrates the feasibility of using data on field demands for parts to improve push packages for new equipment as it is fielded to successive units. This document should be of interest to logistics personnel, especially staff involved in inventory and stock positioning decisionmaking, provisioning personnel, program managers, and resource managers.

The project was jointly sponsored by the Army Deputy Chief of Staff for Logistics (G4) and Army Deputy Assistant Secretary for Acquisition Policy and Logistics. The research was conducted within RAND Arroyo Center's Military Logistics Program. RAND Arroyo Center, part of the RAND Corporation, is a federally funded research and development center (FFRDC) sponsored by the United States Army.

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Questions and comments regarding this research are welcome and should be directed to the leader of the research team, Marygail Brauner, at Marygail@rand.org.

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Summary

When new equipment comes into the Army, it is often fielded on a unit-by-unit basis over a period of many years. This is true whether the Army is fielding an entirely new weapon system, such as the M777 lightweight howitzer, or an upgrade of an existing weapon system, such as the CROWS (Common Remotely Operated Weapon Station), which allows the soldier to acquire targets and fire the weapon from within an armored vehicle. For new equipment, the program manager (PM) works with the vendor to develop an initial parts list for sustainment, which is known as a "push" package (PP). The push package becomes part of the supply support activity's (SSA) authorized stockage list (ASL), along with other parts required to keep the unit's equipment mission-capable.

Although new equipment fielding typically occurs in phases over time, empirical demand data from the earliest fieldings have not typically been used to update the ASL or the push package. As a result, even for systems that have been used for years, the push package may be based on the original engineering estimates of failure rates with few or no changes based on empirical demand data from field experience.

RAND Arroyo Center researchers believed that demand data from the field could be used to improve push packages, increasing equipment readiness and reducing the number of unused items. Arroyo initially tested this approach for MRAP (Mine Resistant Ambush Protected) vehicles, which the Army began rapidly fielding in 2008. Arroyo simulated the performance of the ASL push package being fielded with several variants of MRAPs against actual demands for MRAP-unique parts and found that overall the performance was poor. Hence, special runs were made monthly to analyze MRAP-unique parts demands; these parts were rapidly added to the ASL of SSAs supporting the appropriate MRAP variants. As a result, ASL performance began to improve quickly. Even after a single ASL update, the accommodation rate for the ASL

(i.e., the percentage of parts demanded that were on the ASL) for MRAP-unique parts increased from less than 20 percent to 31 percent.

This documented briefing demonstrates the feasibility of using demands from an earlier fielding to improve the push package as new equipment is fielded to successive units. We conducted case studies for the lightweight howitzer (M777) and the new armored security vehicle (ASV). We also provide suggestions for improving the process for developing push packages.

Process for Using Field Data to Update Push Packages

Figure S.1 illustrates the process of using demand data from earlier fieldings to improve push packages as new equipment is fielded to successive units. PP0 is the initial push package, which is based largely on engineering estimates, test data, experience with similar parts on similar equipment, and, in some cases, input from subject matter experts (SMEs). The new equipment and PP0 are given to the first unit in the fielding sequence. As the unit uses the new equipment, its demands for repair parts are recorded in the Army supply system. To develop an improved push package (PP1), the performance of PP0 is reviewed along with the newly available demand data from the first unit. The second fielding of new equipment is given an improved push package, PP1, which has been improved based on demand data. Now two Army units are generating demands for repair parts, and these data can be used to develop a further improved push package, PP2, for use with the next unit that receives the new equipment. And so on.

Case Studies of M777 and ASV

We used simulation to evaluate the performance of alternative push package designs, including some developed without demand-based data (i.e., instances of PP0 in Figure S.1) and some developed with demand-based data (instances of PP1 in the figure) to support the M777 and the ASV.

Figure S.1
Demands Are Used to Update Push Packages as Equipment Is Fielded
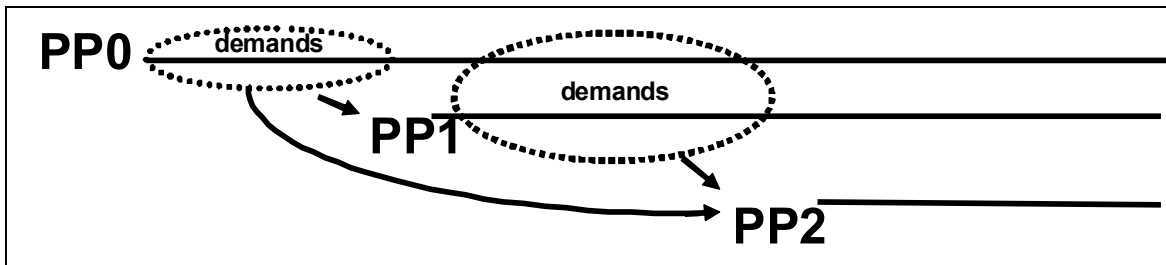
The simulation was used to evaluate both Army-developed and Arroyo-developed push packages. For the M777, we evaluated push packages generated using four different methods, shown in Table S.1. For each package, the table shows the method and model used, and the number and value of parts. The push package developed by SMEs and fielded to the 10th Mountain Division contained 293 parts and was valued at $920,000. The Visual SESAME Readiness Based Sparing (RBS) model produced a push package with 662 parts at a value of $111,000. This model is designed to produce a least-cost part list to obtain 80 percent weapon system availability. CCSS produced an ASL push package using the Support List Allowance Card (SLAC) that contained 39 parts valued at $79,000.

Table S.1
M777 Push Packages Were Generated Using Four Different Methods

Method	Model	Push Package	# NIINs	Value
SME	PP fielded to 10th MTN	PP0 actual	293	$920K
RBS	Visual SESAME	PP0 budget	662	$111K
CCSS	SLAC	SLAC	39	$79K
Use field demands	Extended Dollar Cost Banding	PP1 nondeployed	21	$104K
		PP1 deployed	28	$104K

RBS = Readiness Based Sparing; Visual SESAME = Selective Stockage for Availability, Multi-Echelon; CCSS = Command Commodity Standard System; SLAC = Support List Allowance Card; NIIN = National Item Identification Number.

Arroyo developed two push packages using FY09 field demands. The first push package (PP1 nondeployed) used the demands from a nondeployed fires battalion, W0S in CONUS. In FY09, the unit had 166 demands for M777 parts. PP1 nondeployed contained 21 parts valued at $104,294. The second push package (PP1 deployed) used the demands from a deployed fires battalion, W0P in Afghanistan. In FY09, W0P had 215 demands for M777 parts. PP1 deployed contained 28 parts valued at $103,619.

To evaluate the alternative push packages, we simulated the performance of each in meeting the same streams of demands for repair parts: FY10 demands for repair parts from deployed units in Afghanistan (W0F) and nondeployed units in Germany (WA3) and a brigade combat team in Hawaii (WHJ). There were 631 demands for M777 parts from the W0F's ASL in Afghanistan, 179 M777 demands from WA3 in Germany, and 175 demands for M777 from WHJ in CONUS.

The Push Package for the M777 Improved Greatly Using Field Data from Afghanistan

As shown in Figure S.2, we were able to develop a much improved push package (PP1) using field data from Afghanistan (W0P). These graphs show the simulation results for demands from W0F—an SSA supporting a unit in Afghanistan with 20 howitzers.

The graph on the left shows performance of the push packages meeting demands for all Class IX (repair) parts; during the time period of the simulation (August 2009 to July 2010), 97 Class IX NIINs had demands.

- PP0 actual (10th Mountain PP) had a poor accommodation rate (11 percent) and poor fill rate[1] (7 percent), but it had sufficient stock of

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[1]"Fill rate" refers to the percentage of requests that are immediately filled from the supporting ASL.

those parts that were accommodated so that the satisfaction rate[2] was good (63 percent).

- PP0 budget (the SESAME PP), with 662 parts, had a good simulated accommodation rate (38 percent), but the satisfaction rate was poor because the quantity for most of the parts in PP0 budget was one.
- PP1 deployed, a demand-based push package, had the best performance, with an accommodation rate[3] of almost 80 percent as well as fair satisfaction (28 percent) and fill (22 percent) rates.

Figure S.2
Field Data from Afghanistan Were Used to Update Push Packages

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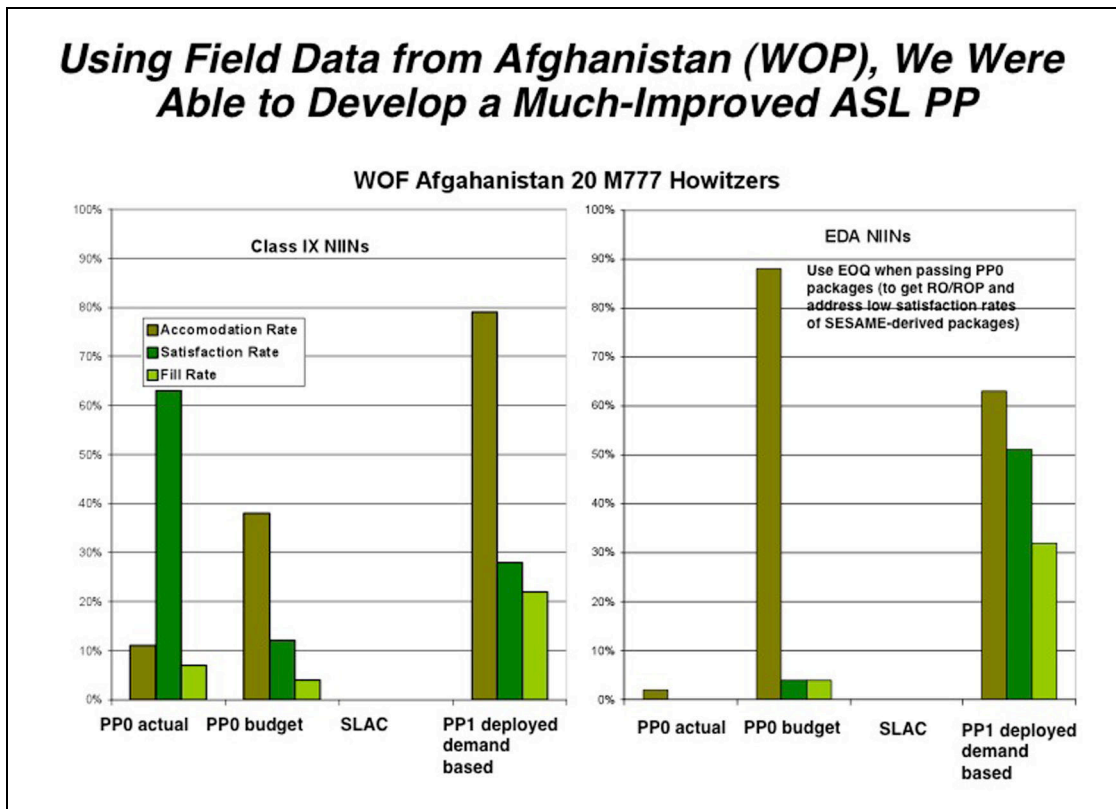
[2]"Satisfaction rate" refers to the percentage of accommodated requests for which there is stock available at the time of the request.

[3]"Accommodation rate" is the percentage of demands for parts on the ASL, whether or not the needed part is available.

The graph on the right of Figure S.2 displays the simulation results for 24 critical howitzer parts: in this usage, "critical" means that according to EDA (equipment downtime analyzer) data, these parts were required to return the howitzer to mission-ready status.[4]

- Neither the PP0 actual push package nor the SLAC push package contained these critical parts.
- The PP0 budget push package had an accommodation rate of 88 percent, meaning that it contained almost all the critical parts, but the low satisfaction rate of 4 percent indicated that the depth of the stockage for these parts was insufficient to meet demands. The PP0 budget push package had low satisfaction rates because the authorized quantity recommended on most parts was one. Using an economic order quantity (EOQ, if greater than one) to increase the requisition objective (RO) for some items and using the authorized quantity as the reorder point (ROP) would improve the satisfaction rate for the PP0 budget-recommended push package.
- As with all Class IX repair parts, the PP1 deployed demand-based push package performed well for the EDA critical parts; accommodation and satisfaction rates were 63 and 51 percent, respectively.

Similar Results Were Achieved for Nondeployed Units

The results were similar when we simulated the performance of each push package in meeting the streams of demands for repair parts from nondeployed units in Germany (WA3) and a brigade combat team in Hawaii (WHJ). WA3, an SSA in Germany, supports 18 howitzers; WHJ supports a Hawaiian unit with 16 howitzers. The demand-based push packages had good accommodation and satisfaction rates. Because the PP0 budget push package had over 600 parts,

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[4]The EDA tracks critical parts that caused equipment to be non-mission-capable. EDA data link part NIINs to a particular end-item.

the accommodation rate was very good (89 percent), but lack of depth made the satisfaction rate very low (12 percent). The other push package, PP0 actual, did not perform well. For WHJ, both demand-based push packages had high Class IX accommodation rates (89 percent and 97 percent), although the lack of depth again made the satisfaction rates very low.

Use of Field Data Also Led to Improved Push Packages for the ASV
For the ASV, we evaluated three push package designs developed without the benefit of empirical demand data: two push packages developed by SMEs—the initial Fort Carson Installation Supply Representative (ISR)-developed push package (in Table S.2, called PP0 actual1) and the Carson push package that was actually fielded (PP0 actual2), as well as a SESAME push package (PP0 budget). Using one year of demands from a military police (MP) battalion supported by W0F in Afghanistan, we developed one demand-based push package (PP1 demand based). Data on the composition of these alternative push package designs are summarized in Table S.2.

Table S.2
Four ASV Push Packages Were Compared

Method	Model	# NIINs	Value
SME	PP0 actual1	44	$29K
SME	PP0 actual2	44	$24K
RBS	PP0 budget	493	$38K
Field demands July 2008 to June 2009	PP1 demand based	111	$39K

An MP battalion has four MP companies with nine vehicles each. We simulated how well each of the push packages supported a CONUS-based MP battalion with 299 demands. Simulation results are shown in Table S.3. For both Class IX and EDA-critical parts, the demand-based push package had the highest accommodation, satisfaction, and fill rates. The PP0 budget push package had a low accommodation rate but a satisfaction rate between those of

Table S.3
Simulation Performance of ASV Push Package

Push Package	Class IX Parts			EDA Critical Parts		
	Accommodation Rate	Satisfaction Rate	Fill Rate	Accommodation Rate	Satisfaction Rate	Fill Rate
PP0 actual1	25%	39%	10%	9%	73%	7%
PP0 actual2	25%	80%	20%	9%	73%	7%
PP0 budget	8%	54%	4%	5%	50%	2%
PP1 demand based	38%	83%	32%	79%	83%	66%

the two Carson PPs. Clearly, the demand-based push package gave the best simulated performance for the ASV using these data.

Suggested Improvements

The Army should continuously update push packages during the roll-out of new equipment. We offer the following steps to guide the development of a systemic process for improving push packages prior to each new fielding:

- Starting with a list of NIINs that are applied to the newly fielded systems and the initial push package, determine which items are unique to the new system (i.e., new NIINs added to the catalogue). The items that are unique to the newly fielded system tend to drive the initial sustainment challenges.
- As new systems are fielded, the Army should analyze demands from the Army supply system at the supporting SSA/DODAACs and EDA data. The latter can potentially identify new items linked to the newly fielded system (this occurred in the case of MRAP), either because they simply were not listed or engineers did not anticipate a failure mode. Use the EDA data to determine item criticality and the supply data to estimate demand or failure rates (in conjunction with end-item density)

- As additional end-items are fielded, the demand data and EDA data can be integrated into the analysis.
- Focus initially on adds and increases to the push package (errors of omission). As more data are accumulated (e.g., 12–24 months of brigade-level data), decrease or delete items off the original push package if not supported by demands (errors of inclusion). Continue to update the push package even after fielding is completed to adjust ASLs when the equipment changes support relationships due to task force organization or other support missions in contingencies.

Acknowledgments

Glossary

AAC	Acquisition Advice Code
ABF	Asset Balance File
AMCOM	Aviation and Missile Command
AMSAA	Army Materiel Systems Analysis Activity
APS	Army Prepositioned Stock
ASA(ALT)	Assistant Secretary of the Army, Acquisition, Logistics and Technology
ASL	Authorized Stockage List
ASV	Armored Security Vehicle
CCSS	Command Commodity Standard System
CECOM	Communications and Electronics Command
CONUS	Continental United States
CROWS	Common Remotely Operated Weapon Station
DLA	Defense Logistics Agency
DODAAC	Department of Defense Activity Address Code
EDA	Equipment Downtime Analyzer
EDCB	Enhanced Dollar Cost Banding
EOQ	Economic Order Quantity
FLIS	Federal Logistics Information System
FSC	Federal Supply Classification
GSA	General Services Administration
IM	Item Manager
ISR	Installation Supply Representative
LCMC	Life Cycle Management Command
LMP	Logistics Modernization Program

LOGSA	Logistics Support Agency
MP	Military Police
MRAP	Mine Resistant Ambush Protected Vehicle
NIIN	National Item Identification Number
NSN	National Stock Number
OCONUS	Outside Continental United States
OEM	Original Equipment Manufacturer
PBOM	Provisioning Bill of Material
PLL	Prescribed Load List
PM	Program Manager
PP	Push Package
PPL	Provisioning Parts List
RBS	Readiness Based Sparing
RO	Requisition Objective
ROP	Reorder Point
SAP	Systems Applications and Products
SESAME	Selective Stockage for Availability, Multi-Echelon
SLAC	Support List Allowance Card
SME	Subject Matter Expert
SM&R	Source, Maintenance, and Recoverability
SSA	Supply Support Activity
SSR	Supply Support Request
TACOM	Tank-automotive and Armaments Command
WA3	SSA in Germany
WAN	SSA in CONUS
WFN	SSA in CONUS
WGB	SSA in CONUS

WHE	SSA in CONUS
WHJ	SSA in CONUS
W0F	SSA in Afghanistan
W0P	SSA in Afghanistan
W0S	SSA in CONUS

1. Introduction and Background

Using Field Data To Improve
ASL Push Packages (PP)

Sponsors - Army G-4 & ASA/ALT

Marygail Brauner

This documented briefing was developed for the Army's Deputy Chief of Staff G4/Logistics and the Assistant Secretary of the Army for Acquisition, Logistics and Technology. The information was briefed to them and their assistants in September 2010. The analysis reported here was jointly sponsored by both offices.

When new equipment comes into the Army, it is often fielded on a unit-by-unit basis over a period of many years. This is true whether the Army is fielding an entirely new weapon system, such as the M777 lightweight howitzer, or an upgrade of a weapon system, such as CROWS (Common Remotely Operated

Weapon Station).[5] For new equipment, the program manager (PM) works with the vendor to develop an initial parts list for sustainment, which is known as a "push package." The push package becomes part of the supply support activity's (SSA) authorized stockage list (ASL), along with other parts required to keep the unit's equipment mission-capable.

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[5]CROWS consists of a mount, an automatic weapon, video and thermal cameras, sensors, range finders, fire control system, etc. Its mounts on top of a vehicle and allows the soldier to acquire targets and fire the weapon from within the safety of the vehicle.

Motivation for this Research

- Fielding of new equipment typically occurs over time
- Rarely is empirical data used to improve push packages for later fieldings
- If push packages do not contain the parts that drive readiness levels on the new equipment, readiness problems can occur
  - Poor combat effectiveness
  - Public perception of the value of new equipment
- Support for Army systems has improved through the use of empirical data to update ASLs with parts and quantities needed to maintain high equipment availability

Although new equipment fielding typically occurs in phases over time, empirical demand data from the earliest fieldings are not systemically used to update either the ASL or the push package. As a result, even for systems that have been in service for years, the push package may remain based on the original engineering estimates of failure rates with little or no changes incorporated based on empirical demand data from field experience.

If push packages for a system provide low fill rates for the parts that drive readiness levels on the new equipment, which has frequently been the case, readiness problems can occur. A readiness problem associated with newly fielded systems can become both a combat effectiveness and a public perception issue. Because new weapon systems typically bring upgraded combat capability but are limited in number, it is critical to keep readiness rates high. With nothing more than engineering estimates of failure rates and potentially limited production capacity, maintaining high equipment availability can be a challenge.

Working with the Expert ASL Review Team,[6] RAND Arroyo Center has been using empirical data to continually and rapidly update ASLs to better support Army systems, including newly fielded equipment such as Mine Resistant Ambush Protected (MRAP) vehicles. It is expected that this process can be adapted to update the push packages as well. Moreover, it is possible that experience from past fieldings could be used to improve the development of the initial push package, to include the identification of part types that are the best candidates to provide value to the push package.

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[6]The Expert ASL Review Team is an Army organization within Logistics Support Agency (LOGSA) that centrally calculates the repair parts needed for all Army ASLs. The list of parts is tailored to the demands of the unit. Details can be found in Girardini, et al., 2004. See also ALARACT, 2009.

Academic Research, Commercial Practice, and RAND's Studies Advocate Use of Historical Data

- Academic literature contains new approaches to forecasting
  - Replacement parts
  - Parts with intermittent demands
- Commercial use of bootstrapping technique using large industrial data sets
- Multi-echelon forecasting models
  - METRIC
  - Readiness Based Sparing (RBS)
- RAND
  - Army
    - M1 tanks
    - APS performance
  - Air Force—Aging Aircraft

Commercial firms have begun substituting data-based estimation for estimation methods based on theoretical distributions when forecasting intermittent demands—irregular or random demands with a large proportion of zero values. Academics began looking at this problem 40 years ago with the publication of "Forecasting and Scheduling for Past-model Replacement Parts" (Moore, 1971, pp. B200–B213). The conclusions of this paper state, "Since the forecasting model recomputes all-time requirements in every quarter using an improved data base, i.e., more recent sales information, increasingly reliable estimates of sales patterns are obtained" (p. B212). Research by practitioners and academics continued; in 2000, the National Science Foundation awarded a competitive Innovation Research Grant for the development of a new method for forecasting intermittent demand. The new method used historical intermittent demand data to create thousands of sample demand patterns over a lead time and applied the statistical "bootstrap method" to produce forecasts of inventory requirements. More papers followed these publications. A paper in

the *International Journal of Forecasting* states, "Using nine large industrial datasets, we show that the bootstrapping method produces more accurate forecasts of the distribution of demand over a fixed lead time than do exponential smoothing and Croston's method" (Willemain, 2004, p. 375). Another paper by Syntetos and Boylan quantified the accuracy of intermittent demand estimates using demand histories (Syntetos and Boylan, 2005, pp. 303–314).

At the same time, another line of forecasting research determined the base and depot stock levels for reparable parts to optimize system performance for specified levels of investment. The METRIC model was the first such multi-echelon, multi-item optimization model used by the U.S. military (Sherbrooke, 1966). METRIC evolved into other models called Readiness Based Sparing (RBS) models: these determine component/part stockage quantities to achieve a given weapon system target operational availability at least cost. Selective Stockage for Availability, Multi-Echelon (SESAME) is the Army's RBS model for determining initial stock requirements for all ASL and PLLs (Prescribed Load Lists) (Kaplan, 1980).

Several RAND studies have shown the importance of updating failure factors based on empirical data. One study looked at the relationship between age and failure rates for Army tanks. It found that "a 14-year-old tank will have approximately double the expected number of failures of a brand new tank, for a given location, usage, and time period"(Peltz et al., 2004, p. 69). Unpublished RAND research on Army Prepositioned Stock (APS) showed poor performance of these ASLs, which were built using failure factors based on engineering estimates versus empirical data.[7]

Other RAND research for the Air Force showed that "some aircraft (or engine) components have initial design or manufacturing defects that lead to an initial infantile-failure period, when demands for some parts are initially high,

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[7]The research was conducted by Kenneth Girardini and Eric Peltz.

until those defects are corrected" (Pyles, 2003, p. 27). The point of the paper was that failure factors change over the life of the weapon system. Some components experience decreasing failure rates, and other components wear out and have increasing failure rates.

In 2009, ASL Performance for MRAP Was Improved Over PP with ASL Review Process

Push package (PP) is the parts added to the ASL to support recently fielded equipment
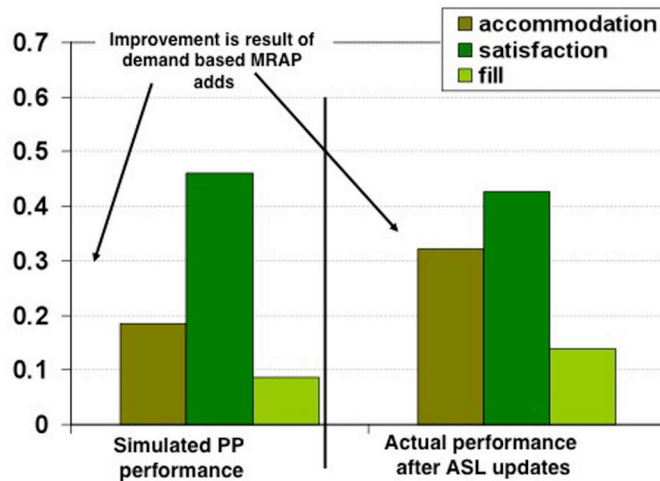
Data source: 2008 demands for MRAP unique NIINs

Definitions:

- **Accommodation rate:** the percentage of requests for items that are on the ASL (have a requisition objective (RO) > 0), whether or not the requested item is immediately available.
- **Satisfaction rate:** the percentage of accommodated requests for which there is stock available at the time of the request.
- **SSA fill rate:** the percentage of requests that are immediately filled from the supporting SSA.

The value of utilizing early demand experience to update ASLs was suggested by an exercise carried out by RAND Arroyo Center involving MRAPs.[8] In 2008, the Army was rapidly fielding MRAP vehicles to meet

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[8]Unpublished RAND research conducted by Kenneth Girardini.

critical equipment needs in Iraq and Afghanistan. Once demand data were available, RAND simulated the performance of the ASL push package being fielded with several variants of MRAPs against actual demands for MRAP-unique parts and found that overall the performance was poor. Hence, special runs were made monthly to analyze MRAP-unique parts demands; these parts were rapidly added to the ASL of SSAs supporting the appropriate MRAP variants. As a result, ASL performance began to improve quickly.

The simulation results are shown in the left graph in terms of the three metrics defined above. Prior to incorporating ASL updates, the accommodation rate was less than 20 percent, and the satisfaction rate was 45 percent.[9] The simulation assumes there are parts in the supply system to replenish the ASL.

The graph on the right shows the actual performance of a new demand-based ASL computed after three months of demand data were available. This demand-based review added 1,188 parts worth $2.8M and increased the quantities of existing ASL parts by $1.7M. After a single ASL update, the accommodation rate for the ASL (i.e., the percentage of parts demanded that were on the ASL) for MRAP-unique parts increased from less than 20 percent to 31 percent. The satisfaction rate was 42 percent. Note that in the actual data, ASL replenishments may have been backordered, leading to lower satisfaction and fill rates. The push package simulation used the same actual demands that were used to measure the demand-based ASL.[10]

This improvement, using an ASL containing MRAP-unique parts, suggested a new process for developing push packages for future fielding of all

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[9]The fill rate is the product of the accommodation and satisfaction rates. It measures the percentage of demands that are immediately filled from the ASL. Army logisticians decompose fill rates into the two components because stockage decisions are made sequentially—first, what parts to include (breadth) and then how many of each (depth).

[10]The demands used for the new demand-based ASL and those used to measure the performance of the initial push package and the demand-based ASL were Armywide demands from five MRAP variants (RG-31, RG-33L, MAXXPRO, Caiman, and Cougar) that were being used in the fall of 2008.

new equipment. RAND researchers believed that by using demand data from previously fielded MRAPs, the push package could be successively improved.

Objective

- **Recommend Army policy/ procedures for improving ASL push packages**

- **Demonstrate feasibility and benefit of rapidly updating push packages as new equipment is fielded to successive units using empirical demand data from earlier fieldings**
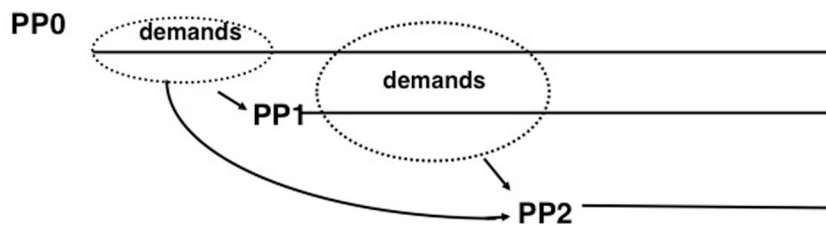
The improvements in the MRAP ASL push package suggested the need for a review of Army policy and procedures for developing ASL push packages with the goal of recommending changes that would institutionalize the improvements seen in the ASLs supporting the MRAP.

Additionally, we sought to demonstrate the feasibility of using demand data from earlier fieldings to improve push packages, increase equipment readiness, and reduce the number of unused items as new equipment is fielded to successive units.

The graphic at the bottom of the chart illustrates the process. PP0 is the initial push package, which is based largely on engineering estimates, test data, experience with similar parts on similar equipment, and, in some cases, input from subject matter experts (SMEs). The new equipment and PP0 are given to the first unit in the fielding sequence. As the unit uses the new equipment, its demands for repair parts are recorded in the Army supply system. These include demands for parts that are not in PP0 but cause the equipment to be non-

mission-capable.[11] To develop an improved push package (PP1), the performance of PP0 is reviewed along with the newly available demand data from the first unit. The second fielding of new equipment is given an improved push package, PP1, which has been improved based on demand data. Now two Army units are generating demands for repair parts, and these data can be used to develop a further improved push package, PP2, for use with the next unit that receives the new equipment. And so on.

The MRAP analysis showed it was possible to improve ASLs with as little as three months of data. The analysis reported in this paper uses twelve months of demand data when calculating improved push packages.

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[11]End-items with failures that render them non-mission-capable are considered "deadlined." The Army daily collects information on deadlined reportable equipment, the reason for the deadline, and the parts still needed to complete the repair. Later in this report we will call these data EDA (equipment downtime analyzer) data. (Peltz et al., 2002)

Research Approach

- **Obtain actual ASL push packages**
  - List of parts
  - Quantities
  - Reorder point (ROP)

- **Obtain demands from units with new equipment**

- **Identify parts that are readiness drivers**

- **Use simulation to calculate performance metrics**

- **Assess opportunities to improve the initial package**

During the evaluation phase of the project, we began by obtaining actual ASL push packages for several new weapon systems. These push packages contained a list of parts, the quantity of each part that should be kept at the SSA, and the reorder point (ROP)—the inventory level when an order for more stock should be placed. Using demands from units with new equipment, we identified parts that were critical to maintaining high rates of equipment readiness.

We used simulation to evaluate the performance of having a specific list of parts in an ASL. The list of parts, the quantity (RO) of each part, ROP for each part, and actual field demand streams were input to a computer program that simulated replenishment of parts based on a replenishment time of 15 days CONUS (continental United States) and 20 days OCONUS (outside continental United States) and calculated accommodation, satisfaction, and fill rates to measure the performance of the parts list.

2. How ASL Push Packages Are Developed

Outline

- **"Walk the process" of building ASL push packages**
  - CECOM: conference calls
  - TACOM: Warren
  - TACOM: Rock Island
  - AMCOM: no recent fieldings
- Case studies: M777 and ASV
  - Actual fielded push package
  - Visual SESAME push package
  - SLAC push package
  - Push package improved with actual data
- Suggest improvements

The remainder of this documented briefing is divided into three sections. The first section describes how ASL push packages are developed at the Army's life cycle management commands (LCMCs). The study team conducted conference calls with personnel at CECOM (Communications and Electronics Command) to discuss the development of push packages under LMP.[12] We also visited TACOM (Tank-automotive and Armaments Command) in Warren, Michigan, and Rock Island, Illinois. At the time of our

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[12] The Logistics Modernization Program (LMP) is a resource management tool that supports the Army's supply chain. LMP is an Army implementation of the commercial Systems Applications and Products (SAP) resource planning software. CECOM was the first major subordinate command to implement LMP in 2003.

visit, TACOM was still using CCSS (Command Commodity Standard System) to develop ASL push packages. The Aviation and Missile Command (AMCOM) has not developed ASL push packages recently because there has been no recent fielding of new or upgraded equipment.

The second section of the briefing presents our case studies for the lightweight howitzer (M777) and the new Armored Security Vehicle (ASV). The last section concludes, with suggestions for improving the ASL push package process.

Process Used by CECOM Under LMP for Push Package Development

- Provisioning Parts List (PPL)
  - Provided by contractor
  - Includes test failure factors
  - Reviewed by engineer
- PPL is loaded onto LMP staging area and the provisioner:
  - Executes various processes to identify new parts requiring catalogue entries
  - Performs a compliance check and enters the catalogue information into LMP
  - Submits an SSR (supply support request) to DLA cataloging
- DLA returns information on the new NIINs and the provisioner executes numerous processes to create the PBOM
- Run Visual SESAME
  - Budget $
  - National-level provisioning
  - Push package based on density of fielded equipment
- Provide SESAME output to PM / IM for review
- Enter approved SESAME data into LMP
  - LMP provides requirements to DLA and AMC IM
- PM develops push package
- Equipment fielded with push package

May be > 2 years

When developing an ASL push package for new equipment, the contractor provides the program manager (PM) a list of parts called the provisioning parts list (PPL). The PPL includes "failure factors,"[13] which are based on engineering estimates, test data, and experience with similar parts on similar equipment. The PPL information is reviewed by engineers, who check the essentiality code, maintenance repair code, and failure factors to ensure that they are consistent with similar Army repair parts.

After engineering review, the PPL is loaded into LMP's staging area where the person working on provisioning

- Executes the Federal Logistics Information System (FLIS) screening of the entire file; this is an automated process in which LMP

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[13]Failure factor is estimated removal/replacement per 100 end-items per year based upon peacetime usage.

communicates with FLIS and FLIS returns catalog information to LMP.

- Runs an LMP process to identify items that do not have a national stock number (NSN); these are identified by LMP code 10.
- Researches code 10 items to verify that the part is a new item.
- Executes a compliance check; this is a LMP process that prompts the provisioner to enter the required cataloging data into LMP.

Next, provisioners build a supply support request (SSR). The SSR contains codes that are necessary for proper parts management. These codes include the Source, Maintenance, and Recoverability (SM&R) Code, Federal Supply Classification (FSC), Acquisition Advice Code (AAC[14]), Recoverability Code, etc. The SSR is sent to the Defense Logistics Agency (DLA) cataloging personnel, where the new National Item Identification Numbers (NIINs) are assigned.

When the catalogue data is received, a process is executed to create a Provisioning Bill of Material (PBOM) containing catalogue and PPL information. In an offline process, the PBOM is entered into Visual SESAME[15] to produce parts and quantities for national-level provisioning, and an ASL push package based on the density of the equipment being supported is generated. The push package generated by SESAME is specific for the equipment density.

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[14]The acquisition advice code indicates how a part is acquired and whether there are any restrictions—for example, J means not stocked, centrally procured; L means local purchase; Y means terminal item procurement not authorized. As will be discussed later in this document, the AAC is a particularly important code for provisioning.

[15]Visual SESAME is a PC-based software application of SESAME. SESAME is an Army inventory model developed and supported by Army Materiel Systems Analysis Activity. "The SESAME is the only Army-approved model for computing initial spares requirements for PLLs/ASLs" (U.S. Department of the Army, 2009, p. 12). Also see Kotkin, 2001.

The list of parts SESAME generates is given to the program manager (PM) and item manager (IM) for review. Interviews with PMs at CECOM and TACOM indicated that subject matter experts modify the SESAME parts list and quantities based on their experience with similar equipment and parts. The approved SESAME data is entered into LMP. LMP provides the parts requirement to both DLA and Army Materiel Command IMs. The PM uses the approved data in constructing the actual ASL push package and in budgeting. When the equipment is fielded, the parts on the push package are added to the ASL of the supporting SSA.

The entire process from building the catalogue record to fielding of equipment may take more than two years. That time period is important, as the following discussion will reveal.

Walking the Process Revealed Catalog Issues

Problem	Recommendation
DLA assigns AAC = J (not stocked) until the item is ordered — When fielding is delayed, there may be no demands in 2 years so AAC automatically changes to Y (procurement not authorized) — Not stocking item may force units to order from OEM	— Coordinate with PM / IM before changing AAC J to Y — DLA does not want to procure items that are never ordered
All DLA/GSA NIINs are initially assigned a recoverability code of Z (non-reparable, dispose) — Recoverability code = Z may be coding left over from when DLA only managed non-reparable parts	— Remove default settings, use recoverability code in SSR

Army and AF provisioning personnel expressed concern

Discussions with CECOM and TACOM personnel revealed two problems with the cataloging process. Emails and phone conversations with other provisioning personnel indicated that these problems exist in the Air Force as well as in the Army.

The first problem concerns the acquisition advice code. Without regard to the AAC on the SSR, the DLA automatically assigns all new stock numbers an AAC of "J," meaning "do not stock until part is ordered." Prudent management dictates that DLA cannot afford to procure items that are never ordered, and experience with the forecast accuracy of engineering estimates of failure factors has not been good. However, if fielding is delayed and there have been no demands for the part in two years, the AAC is automatically changed to "Y," meaning "procurement is not authorized." Even when there are demands, not stocking the item often forces units to order directly from the original equipment manufacturer (OEM). Orders to the OEM may not be

recorded in the supply system, so DLA systems may still show no demands for the part.

After consulting with DLA, Army, and Air Force provisioning personnel, our recommendation is to turn off the automatic changing of the AAC from J to Y and coordinate with the PM and IM before changing the AAC.

The second problem concerns so-called "code Z" items. At one time, DLA and the General Services Administration (GSA) only procured and distributed consumable parts—recoverability code Z. Today they also handle reparable parts, but the automated systems that create catalogue records still assign all parts recoverability code Z regardless of the data in the SSR. This may result in improper disposal of items that should be returned to a repair activity. The default setting should be removed and the recoverability code from the SSR used for the catalogue record.

How Much of a Problem Is AAC for Our Case Study Systems?

	M777	ASV
# NIINs	943	1699
# with AAC=J	30	91
# with 2 or more demands	11	33
# with on-hand stock at DLA	2	35
# with AAC=Y	4	20
# with 2 or more demands	1	6
# with on-hand stock at DLA	0	0

Do not know how many demands were filled outside the supply system.

This table shows information in the catalogue as of August 30, 2010 for the M777 and ASV. We were able to identify 943 parts (NIINs) for the M777. Thirty M777 parts had an AAC of J (not stocked), and four had an AAC of Y (procurement not authorized). Some of these parts had two or more demands, and two had stock on hand at a DLA warehouse.

We identified 1,699 parts on the ASV. Of these, 91 had an AAC of J, and twenty had an AAC of Y. Thirty-three of the former had two or more demands, and 35 had stock on hand at a DLA warehouse. Six of the latter had two or more demands, but none of the AAC Y parts had stock on hand.

Because units can go directly to the OEM to order parts, the number of demands filled outside the supply system is not known; we can determine the potential scope but not the true magnitude of the problem.

3. Case Studies

Outline

- "Walk the process" of building ASL push packages
  - CECOM: conference calls
  - TACOM: Warren
  - TACOM: Rock Island
  - AMCOM: no recent fieldings
- Case studies: M777 and ASV
  - Actual fielded push package
  - Visual SESAME push package
  - SLAC push package
  - Push package improved with actual data
- Suggest improvements

We now describe the case studies. We used simulation to evaluate the performance of alternative push package designs, including some developed without demand-based data and some developed with demand-based data, to support the M777 howitzer and the ASV. Each competing push package in a case study was evaluated in a simulation against a common set of demands experienced in a subsequent one-year period.

The M777 lightweight howitzer is a towed artillery piece replacing the older M198 howitzer. It was fielded first to the Marine Corps in 2005 and is used by Canadian (fielded in 2006) as well as U.S. Army forces (fielded in 2008). Currently, the Army has over 18,000 M777s being used by soldiers worldwide.

The ASV is an all-wheel drive armored vehicle used by U.S. military police units. It was first fielded in 1999 and used in Kosovo. At the beginning of the Iraq war, the Army had few ASVs in its inventory, but war requirements led to increased production. As of January 2008, the Army had accepted delivery of 1,270 ASVs.[16]

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[16]"Marine & Land Awarded $228 Million for 329 Additional U.S. Army M1117 Armored Security Vehicles," *dBusinessNews*, January 25, 2008.

We Compared M777 Push Packages Generated with 4 Different Methods

Method	Model	Push Package	# NIINs	Value
SME	PP fielded to 10th MTN	PP0 actual	293	$920K
RBS	Visual SESAME	PP0 budget	662	$111K
CCSS	SLAC	SLAC	39	$79K
Use field demands	Extended Dollar Cost Banding	PP1 non-deployed	21	$104K
		PP1 deployed	28	$104K

The simulation was used to evaluate both Army-developed and RAND-developed push packages. For the M777, we generated push packages using four different methods, as shown in the chart above. For each package, the table shows the method and model used, and the number and value of parts.

The push package developed by SMEs and fielded to the 10th Mountain Division contained 293 parts and was valued at $920,000. The Visual SESAME Readiness Based Spares (RBS) model produced a push package with 662 parts at a value of $111,000.[17] This model is designed to produce a least-cost part list to obtain 80 percent weapon system availability. CCSS produced

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[17] Visual SESAME is a decision support tool that calculates the least-cost lists of parts to support an operational availability goal (Ao). An 80 percent Ao was used to develop this push package. Additionally, "Spare and repair parts quantities will be limited to 10 percent of end-item density and spare and repair parts expenditures will be limited to 10 percent of total hardware cost." See U.S. Department of the Army, 2009, p. 11.

an ASL push package using the Support List Allowance Card (SLAC) that contained 39 parts valued at $79,000.

RAND developed two candidate push packages using FY09 field demands processed though the enhanced dollar cost banding (EDCB) algorithm (Girardini et al., 2004). To make the PP1 push packages comparable to PP0 budget, the parts list was dollar-constrained to be less than or equal to the cost of PP0 budget. The first push package (PP1 nondeployed) used the demands from a nondeployed fires battalion, W0S in CONUS. In FY09, the unit had 166 demands for M777 parts. PP1 nondeployed contained 21 parts valued at $104,294. The second push package (PP1 deployed) used the demands from a deployed fires battalion, W0P in Afghanistan. In FY09, W0P had 215 demands for M777 parts. PP1 deployed contained 28 parts valued at $103,619.

To develop the demand-based push package, the EDCB algorithm uses an economic order quantity (EOQ) formula to trade off the costs of holding items (e.g., costs of purchasing items, needed storage space) against the costs of ordering items (e.g., workload and monetary costs of ordering and receipting items). All else being equal, the order quantity for less expensive items will be greater than that for more expensive items (Buffa, 1983). After the order quantity (RO) is computed, an iterative approach is used to calculate the ROP using a year's worth of actual unit demands. Stocks are replenished using a replenishment time of 15 days CONUS (20 days OCONUS). The ROs and ROPs are iteratively adjusted until the push package meets customer wait time goals.

We Evaluated Performance of M777 Push Packages for Three Types of Demand Streams

- Deployed units in Afghanistan
  - W0P demands (7/2008–6/2009) used to develop "PP1 deployed"
  - W0F demands (8/2009–7/2010) used to simulate how "PP1 deployed" would have performed

- OCONUS units in Germany
  - WA3 demands (2/2009–1/2010) used to simulate performance of both deployed and non-deployed PP1

- CONUS units (W0S, WAN, WFN, WGB, WHE, WHJ)
  - W0S demands (9/2008–8/2009) used to develop "PP1 non-deployed"
  - WHJ demands (6/2009–5/2010) used to simulate how "PP1 non-deployed" would have performed

To evaluate the alternative push packages, we simulated the performance of each in meeting the same streams of demands for repair parts: FY10 demands for repair parts from deployed units in Afghanistan (W0P and W0F) and nondeployed units in Germany (WA3), and a brigade combat team in Hawaii (WHJ).

The W0P demands from July 2008 to June 2009 were used to build a recommended push package, "PP1 deployed." Using that push package, we simulated how it would have performed using demands from W0F from August 2009 to July 2010. Results for W0F follow.

For an OCONUS unit, we utilized demands from WA3 in Germany. There were many CONUS units for which we had demands (W0S, WAN, WFN, WGB, WHE, WHJ). We used demands from W0S from September 2009 to July 2010 to build "PP1 nondeployed." The simulation results for WHJ are reported.

We Used Field Data to Build M777 PPs Using Demand Streams from Two Units
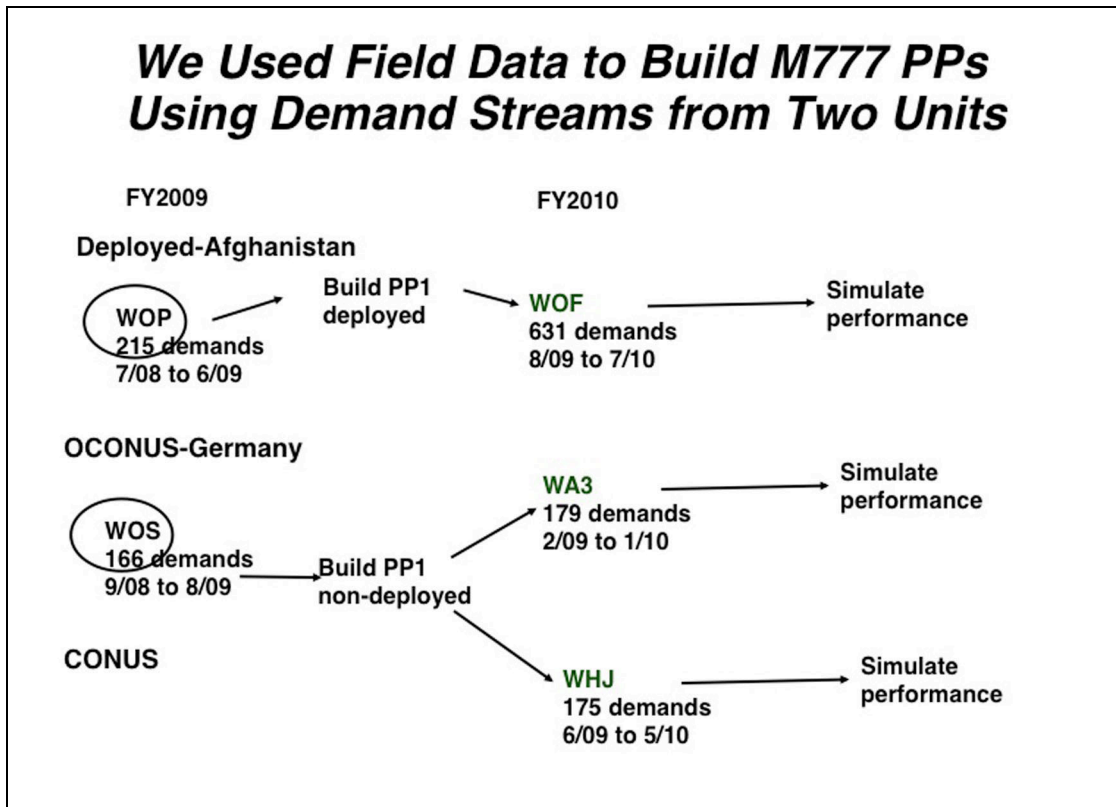
To develop our two demand-based ASL push packages, we compiled a list of M777 parts.[18] This list was composed of parts in the Army-developed push packages plus parts identified in the equipment downtime analyzer (EDA) data as belonging to the M777.[19] Using this parts list, we processed the FY09 demands from W0P (circled in the figure) in Afghanistan through the EDCB algorithm to create a demand-based deployed push package. Similarly, using CONUS demands from W0S (circled in the figure), we developed a demand-based nondeployed push package. The W0P had 215 demands for M777 parts; the W0S had 166 demands.

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[18]Identifying parts that go on a particular Army end-item such as the M777 is difficult. See Galway and Hanks, 1996, pp. 17–39.

[19]EDA data contain critical parts that cause equipment to be non-mission-capable. These critical parts are linked to the end-item NSN of the non-mission-capable equipment. For more information on EDA data, see Peltz et al., 2002.

After developing the demand-based ASLs, we simulated their ability to support demands for M777 parts during FY10. There were 631 demands for M777 parts from the W0F's ASL in Afghanistan, 179 M777 demands at WA3 in Germany, and 175 M777 demands at WHJ in CONUS.

This information is summarized in Table 3.1.

Table 3.1
M777 Demands Used for Push Packages and Simulation Came from Different Time Periods and Different Organizations

Demands used to develop push package		Demands used for simulation	
FY09		FY10	
W0P (Afghanistan)	215	W0F (Afghanistan)	631
W0S (CONUS)	166	WA3 (Germany)	179
		WHJ (CONUS)	175

Using Field Data from Afghanistan (WOP), We Were Able to Develop a Much-Improved ASL PP
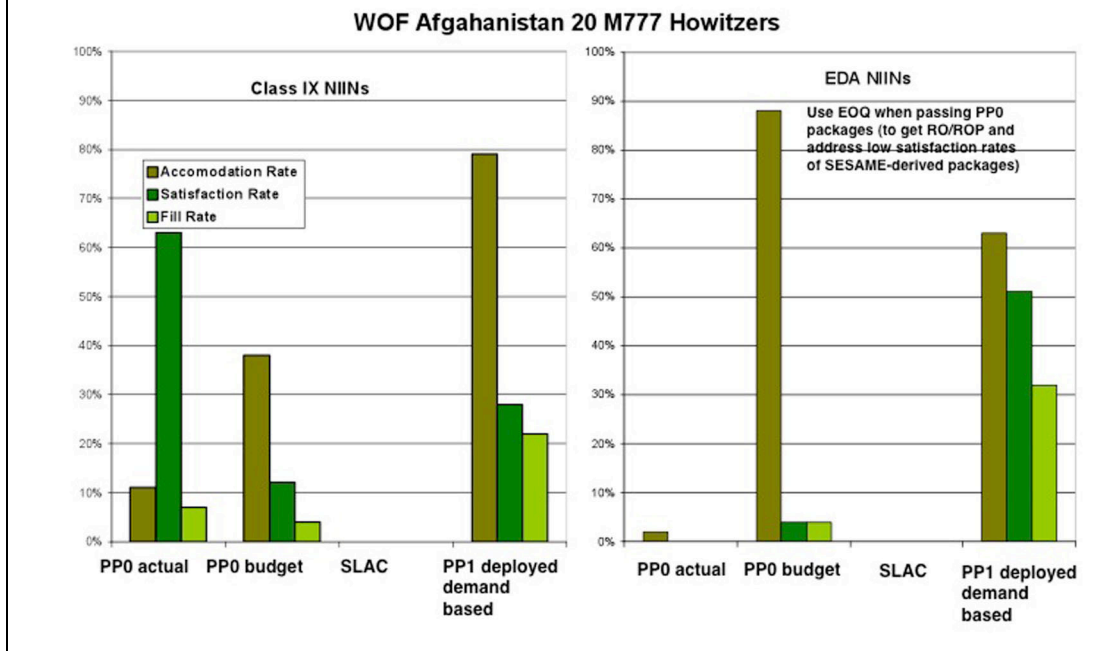
As shown in the chart above, we were able to develop a much improved push package (PP1) using field data from Afghanistan (W0P). These graphs show the simulation results for demands from W0F—an SSA supporting a unit in Afghanistan with 20 howitzers.

The graph on the left shows performance of the push packages meeting demands for all Class IX (repair) parts; during the period of the simulation (August 2009 to July 2010), 97 Class IX NIINs had demands.

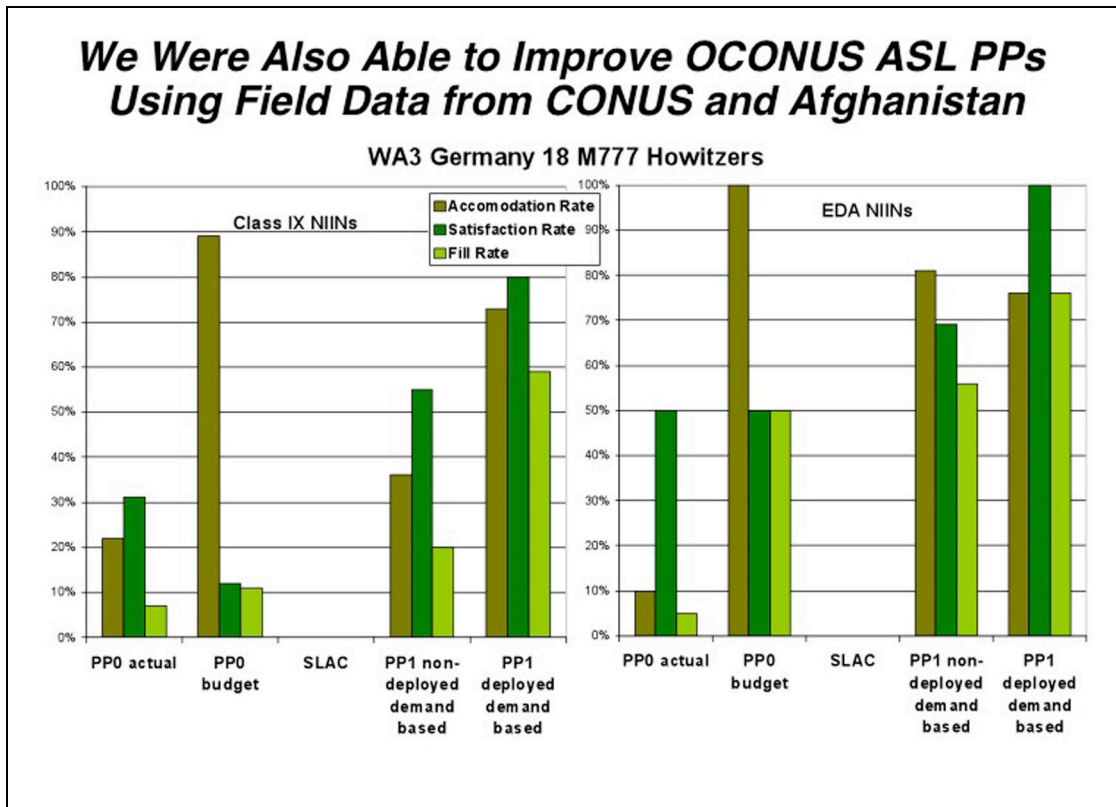- PP0 actual (10th Mountain PP) had poor accommodation rate (11 percent) and poor fill rate (7 percent), but sufficient stock of those parts that were accommodated so that the satisfaction rate was good (63 percent).
- With 662 parts, PP0 budget (the SESAME PP) had a good simulated accommodation rate (38 percent), but the satisfaction rate was poor because the quantity for most of the parts in PP0 budget was one.

- The best performance was from the demand-based PP1 deployed, with an accommodation rate of almost 80 percent as well as fair satisfaction (28 percent) and fill (22 percent) rates.

The graph on the right displays the simulation results for 24 critical howitzer parts: in this usage, "critical" means that according to EDA data, these parts were required to return the howitzer to mission-ready status.

- Neither the PP0 actual (10th Mountain PP) nor the SLAC PP contained these critical parts.
- The PP0 budget push package (SESAME PP) had an accommodation rate of 88 percent, meaning that it contained almost all the critical parts, but the low satisfaction rate of 4 percent indicated that the depth of the stockage for these parts was insufficient to meet demands.

As with all Class IX repair parts, the demand-based PP1 deployed push package performed well for the EDA critical parts; accommodation and satisfaction rates were 61 and 51 percent respectively. The PP0 budget (SESAME PP) had low satisfaction rates because the authorized quantity recommended on 60 percent of the parts was one. In simulating the performance, we used the authorized quantity to set the RO and 75 percent of the authorized quantity (no rounding up) was used to set the ROP. Thus when the RO is one, the ROP is zero. When demands cause the stock level to equal the ROP, wholesale replenishment is initiated using a requisition lead time of 15 days CONUS and 20 days OCONUS. Thus, for all parts with an RO of one, wholesale replenishment is initiated for each demand. Using an economic order quantity (EOQ, if greater than one) to increase the RO for some items and using the authorized quantity as the ROP would improve the satisfaction rate for the PP0 budget-recommended push package.

We Were Also Able to Improve OCONUS ASL PPs Using Field Data from CONUS and Afghanistan

WA3 Germany 18 M777 Howitzers

Results were similar when we simulated the performance of each push package in meeting the streams of demands for repair parts from nondeployed units in Germany (WA3) and a brigade combat team in Hawaii (WHJ). WA3, an SSA in Germany, supports 18 howitzers. During the period of the simulation (February 2009 to January 2010), 43 Class IX NIINs had demands and 12 EDA NIINs had demands. These bar graphs show that both demand-based push packages—PP1 nondeployed and PP1 deployed—performed well for both the Class IX and EDA NIINs. The PP0 budget (SESAME PP) had most of the parts being requested, as seen by the accommodation rates of 89 percent for Class IX parts and 100 percent for EDA parts, but the low satisfaction rate of 12 percent for Class IX parts shows that the push package lacked sufficient depth to satisfy the demands.

We Were Also Able to Improve CONUS ASL PPs Using Field Data from CONUS and Afghanistan
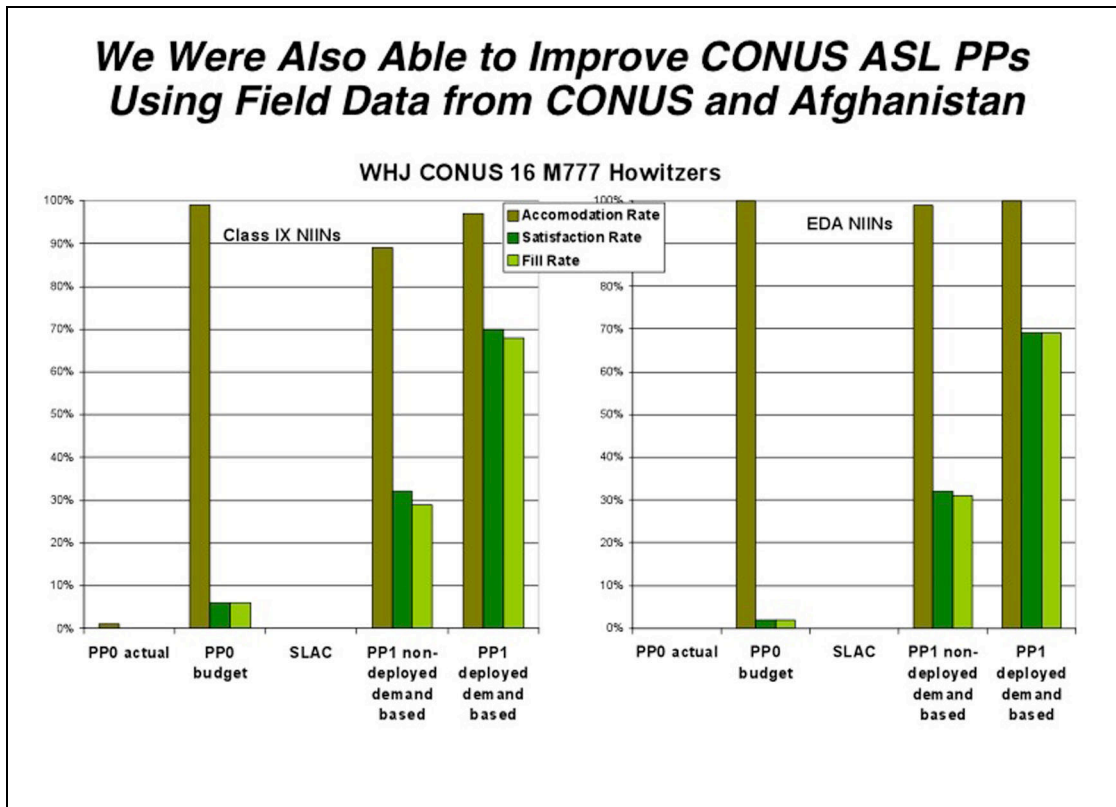
The simulation showed similar results for WHJ, a CONUS SSA supporting a unit with 16 howitzers. During the period of the simulation (June 2009 to May 2010), 16 Class IX NIINs had demands and 11 EDA NIINs had demands. Both demand-based push packages had high Class IX accommodation rates—89 percent for PP1 nondeployed and 97 percent for PP1 deployed. The latter had greater depth than the former and thus a better satisfaction rate. Because PP0 budget (SESAME PP) had over 600 parts, the accommodation rate was very good, but lack of depth made the satisfaction rate very low. The other push packages did not perform well.

We Evaluated Performance of Push Packages for ASV Battalions

7/2008 to 6/2009

8/2009 to 7/2010

WOF Afghanistan
1065 demands

SSA-A CONUS
299 demands

Method	Model	Push Package	# NIINs	Value
SME	Carson ISR	PP0 actual1	44	$29K
SME	Carson PP	PP0 actual2	44	$24K
RBS	SESAME	PP0 budget	493	$38K
Field demands (7/08 to 6/09)	WOF PP	PP1 demand based	111	$39K

ASV Battalion has 4 MP companies with 9 vehicles each

For the ASV, we evaluated three push package designs developed without the benefit of empirical demand data. PP0 actual1 was developed by SMEs— the initial Fort Carson Installation Supply Representative (ISR): it contained 44 NIINs with values of $29,000. PP0 actual2 was the fielded Caron PP: it also had 44 NIINs and cost $24,000. The SESAME PP (PP0 budget) had 493 NIINs and a value of $38,000. Using one year of demands from a Military Police (MP) battalion supported by W0F in Afghanistan, we developed one demand-based push package (PP1 demand based) with 111 parts and a value of $39,000. The W0F data contained 1,065 demands and cover the period from July 2008 to June 2009.[20]

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[20]W0F is the routing identifier code (RIC) for an SSA in Afghanistan. The SSA supports many different units. For this report we looked at the support performance for both the M777 and the ASV.

An MP battalion has four MP companies with nine vehicles each. We simulated how well each of the PPs supported a CONUS-based MP battalion with 299 demands between August 2009 and July 2010.
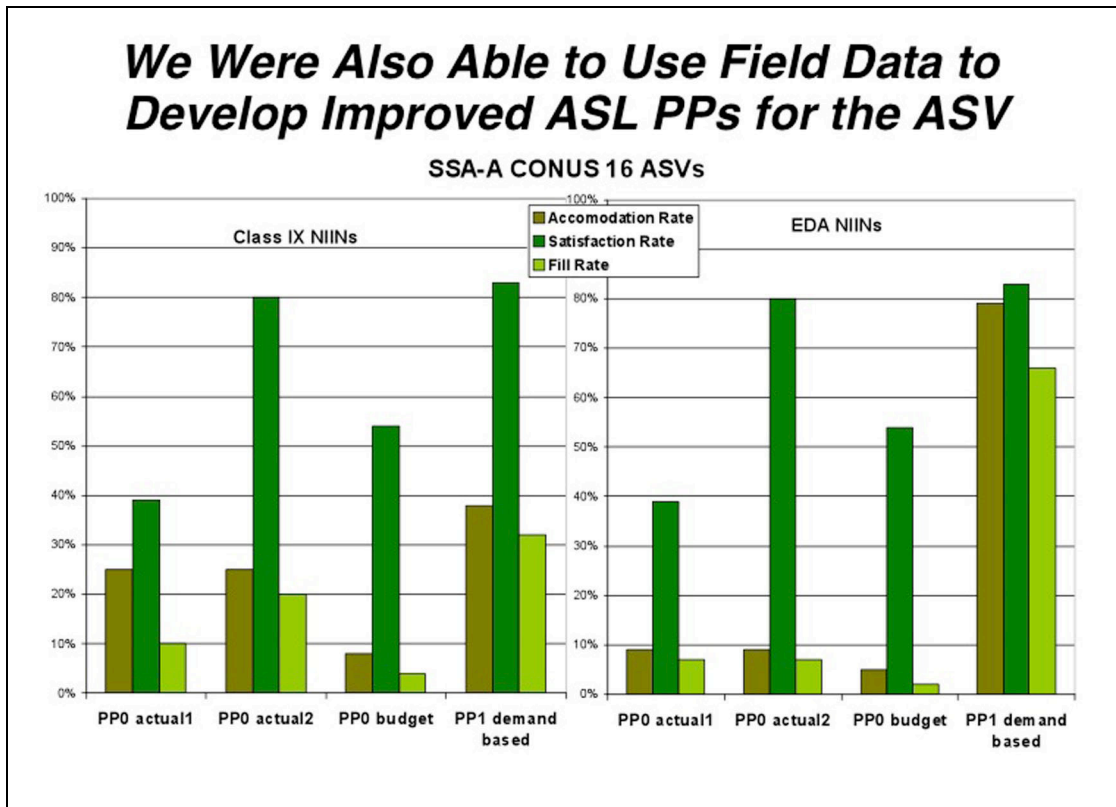
For both Class IX and EDA-critical parts, the demand-based push package (PP1) had the highest accommodation, satisfaction, and fill rates. The PP0 budget (SESAME PP) had a low accommodation rate but a satisfaction rate between those of the two Carson PPs—PP0 actual1 and PP0 actual2. Clearly, the demand-based push package gave the best simulated performance for the ASV using this data.

4. Suggested Improvements

Army Should Continuously Update ASL PPs During Roll Out of New Equipment

1. Starting with a list of NIINs that are applied to newly fielded systems and the initial push package, determine which items are unique to the new system.

2. As systems are fielded, analyze demands from the Army supply system at the supporting SSA/DODAAC's field and EDA data.

3. Use the EDA data to determine item criticality and the supply data to estimate demand or failure rates (in conjunction with end item density).

4. As additional end items are fielded, demand data and EDA data can be integrated into the analysis.

5. Focus initially on adds and increases to the push package (errors of omission). As data accumulate, decrease or delete items from original push package if not demand-supported (errors of inclusion).

6. Continue to update the push package even after fielding is completed

The steps listed on this chart provide a guide to improving ASL push packages as new equipment is issued to Army units.

The Army should continuously update push packages during the roll-out of new equipment. EDA data track critical parts that cause equipment to be non-mission-capable. These data include the end-item NSN, thus linking part NIINs to a particular end-item. We offer the following steps to guide the development of a systemic process for improving push packages prior to each new fielding:

- Starting with a list of NIINs that are applied to the newly fielded systems and the initial push package (PP0), the Army should determine which items are unique to the new system (i.e., new NIINs added to the catalogue). The items that are unique to the newly fielded system tend to drive the initial sustainment challenges.

- As new systems are fielded, the Army should analyze demands from the Army supply system at the supporting SSA/DODAAC's fielded and EDA data. The latter can potentially identify new items linked to the newly fielded system (this occurred in the case of MRAP), either because they simply were not listed or engineers did not anticipate a failure mode. EDA data can be used to determine item criticality and the supply data to estimate demand or failure rates (in conjunction with end-item density)

- As additional end-items are fielded, the demand data and EDA data can be integrated into the analysis. It is desirable to have at least a year's worth of demands to make adjustments to the push package, but this can be achieved in several ways. Three months of demands for four separate units may be aligned sequentially to simulate a year of demands or six months of demands for two units may also be used. Such a demand stream can be input to the EDCB algorithm along with the potential parts list with a RO of one as a starting asset balance file (ABF). Utilizing the potential parts list with a RO of one allows the EDCB process to utilize the less restrictive retain logic to develop the revised push package. This process is similar to the EDCB process currently run by the expert ASL team.

- Updates to the push package should focus initially on adds and increases to the push package (errors of omission). As more data are accumulated (e.g., 12–24 months of brigade-level data), items can be decreased or deleted from the original push package if not supported by demands (errors of inclusion).

- As the new equipment is fielded to additional units, the Army should repeat these steps using additional demand and EDA data to improve the previous push package. The Army should adjust ASLs when the equipment changes support relationships due to task force organization or other support missions in contingencies.

Further Research

We propose further research to improve both retail and wholesale support for newly fielded equipment.

The process for developing initial push packages might be revised based on Army experience with similar equipment, potential data from other services, subject matter expert knowledge, and equipment manufacturer's bill of materials with test data failure factors. For similar equipment, analysis of demand-based, revised ASL push packages may identify characteristics of parts that are readiness drivers for newly fielded equipment. The experience from past fielding could be used to improve the initial push package development process, to include the identification of part types that are the best candidates to provide push package value.

The wholesale supply system is reluctant to purchase parts that are never ordered. It could be beneficial to investigate modifications to the process used to develop initial wholesale parts lists for newly fielded equipment and purchasing strategies that will improve wholesale responsiveness to field demands for readiness drivers on new equipment. Special attention should be paid to the impact of acquisition advice code and recoverability code on stockage decisions. Data should be obtained on unit parts purchases outside the wholesale system to measure perceived wholesale responsiveness and identify additional problems.

The expert ASL team should be involved in designing procedures for rapidly updating initial push packages as empirical demand data from early fielding is available and coordinating with wholesale supply. The details of implementation are critical in successful implementation of new procedures. For example, if new equipment is first fielded to units engaged in wartime operations, their demand rates will be affected by their operations. Calculations of push packages for garrison units using wartime demands may need to be modified.

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